

AMENDMENT UNDER 37 C.F.R. § 1.111  
Application No.: 10/669,891  
Attorney Docket No.: Q77693

### **AMENDMENTS TO THE CLAIMS**

**This listing of claims will replace all prior versions and listings of claims in the application:**

#### **LISTING OF CLAIMS:**

1. (currently amended): A method of assisting with a wiring design of a wiring structure comprising the steps of:

~~regarding representing the wiring structure constituted by a plurality of pieces of line-streak members as an elastic body which has a circular section and in which a plurality of linear beam elements a linearity of which is maintained are coupled with each other;~~

applying information concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure as a predetermined condition to a finite element method;

calculating a predicted shape of the ~~displaced~~-wiring structure such that the predetermined condition is satisfied and the wiring structure is displaced; ~~and~~

outputting the calculated predicted shape of the displaced wiring structure;

determining if the displaced wiring structure is located in a suitable position for the wiring design.

2. (currently amended): The method according to claim 1, wherein the calculating step calculates the predicted shape ~~where~~ such that the wiring structure is forcibly displaced so as to satisfy the predetermined condition.

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3. (currently amended): The method according to claim 1, wherein  
information concerning a change in the shape characteristic, the material  
characteristic and the constraining condition is provided to the ~~outputted-output~~ predicted shape,  
a new predicted shape of the forcibly displaced wiring structure is calculated  
again by utilizing the finite element method, and  
the new predicted shape is ~~outputted-output~~ again to enable to ~~verify~~ verification  
of an optimum shape of the wiring structure.

4. (original): The method according to claim 1, wherein  
the wiring structure is a wire harness wired to a vehicle,  
the constraining condition is defined by coordinates of respective apexes of the  
plurality of beam elements and degrees of freedom at the respective apexes,  
the shape characteristic is defined by a sectional area and a length of the beam  
element of the wiring structure, and  
the material characteristic is defined by a moment of inertia, a polar moment of  
inertia, a density and a longitudinal modulus of elasticity and a transverse modulus of elasticity  
of the beam element.

5. (currently amended): The method according to claim 1, wherein  
in the calculating step, strain and stress of the wiring structure are calculated and

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in the outputting step, the calculated strain and stress are ~~outputted~~ output together with the calculated predicted shape.

6. (original): The method according to claim 5, wherein the calculated strain and stress are displayed in multicolor in accordance with values of the strain and stress.

7. (currently amended): The method according to claim 5, wherein  
in the calculating step, reaction force and moment produced at a constraining point of the wiring structure are calculated, and

in the outputting step, the calculated reaction force and moment are ~~outputted~~ output together with the calculated strain, stress and predicted shape.

8. (currently amended): The method according to claim 1, wherein  
in the calculating step, reaction force and moment produced at a constraining point of the wiring structure are calculated, and

in the outputting step, the calculated reaction force and moment are ~~outputted~~ output together with the calculated predicted shape.

9. (original): The method according to claim 8, wherein the calculated reaction force and moment are displayed by arrow marks.

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10. (currently amended): The method according to claim 1, wherein

in the calculating step, deformation states of the wiring structure deformed from an arbitrary initial shape to a final shape which satisfies the predetermined condition are successively calculated, and

in the outputting step, the calculated deformation states of the wiring structure are successively ~~outputted~~ output.

11. (currently amended): The method according to claim 10, wherein the deformation states of the wiring structure when a predetermined force is applied to a predetermined portion of the wiring structure are successively calculated and ~~outputted~~ output.

12. (currently amended): A method of assisting with a wiring design of a wiring structure comprising the steps of:

~~regarding representing the wiring structure constituted by a plurality of pieces of line-streak members~~ as an elastic body which has a circular section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled each other,

calculating an initial shape of the wiring structure based on a predetermined bending radius, a constrained position of the wiring structure, and a constrained direction with respect to the wiring structure at the constrained position as initial value;

providing, ~~to~~ for the initial shape, a condition concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure;

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calculating a predicted shape of the ~~forcibly displaced~~ wiring structure such that the provided condition is satisfied by utilizing a finite element method and the wiring structure is forcibly displaced with respect to the initial shape; and

outputting the calculated predicted shape; and

determining if the displaced wiring structure is located in a suitable position for the wiring design.

13. (currently amended): The method according to claim 12, wherein

information concerning a change in the shape characteristic, the material characteristic and the constraining condition is provided to the ~~outputted~~ output predicted shape, a new predicted shape of the forcibly displaced wiring structure is calculated again by utilizing the finite element method, and

the new predicted shape is ~~outputted~~ output again to enable to ~~verify~~ verification of an optimum shape of the wiring structure.

14. (original): The method according to claim 12, wherein

the wiring structure is a wire harness wired to a vehicle,

the constraining condition is defined by coordinates of respective apexes of the plurality of beam elements and degrees of freedom at the respective apexes,

the shape characteristic is defined by a sectional area and a length of the beam element of the wiring structure, and

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the material characteristic is defined by a moment of inertia, a polar moment of inertia, a density and a longitudinal modulus of elasticity and a transverse modulus of elasticity of the beam element.

15. (currently amended): An apparatus of assisting with a wiring design of a wiring structure in which the wiring structure ~~constituted by a plurality of pieces of line streak members~~ is ~~regarded~~ represented as an elastic body which has a circular section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled with each other, and a shape of the wiring structure which satisfies a predetermined condition is predicted by utilizing a finite element method, the apparatus comprising:

a setting unit for setting information concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure as the predetermined condition;

a calculating unit for calculating a predicted shape of the ~~displaced~~ wiring structure such that the predetermined condition is satisfied by applying the predetermined condition to the finite element method and the wiring structure is displaced; and

an outputting unit for outputting the predicted shape calculated by the calculating unit for determining if the displaced wiring structure is located in a suitable position for the wiring design.

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16. (currently amended): The apparatus according to claim 15, wherein the calculating unit calculates the predicted shape ~~where~~ such that the wiring structure is forcibly displaced so as to satisfy the condition.

17. (currently amended): The apparatus according to claim 15 further comprising a verifying unit which provides information concerning a change in the shape characteristic, the material characteristic and the constraining condition to the predicted shaped output by the outputting unit, calculates again a new predicated shape of the forcibly displaced wiring structure by utilizing the finite element method and makes the outputting unit output the new calculated predicted shape to enable verification of an optimum shape of the wiring structure.

18. (original): The apparatus according to claim 15, wherein the calculating unit calculates strain and stress of the wiring structure, and the outputting unit outputs the calculated strain and stress together with the calculated predicted shape.

19. (original): The apparatus according to claim 15, wherein the calculating unit calculates reaction force and moment produced at a constraining point of the wiring structure, and the outputting unit outputs the calculated reaction force and moment together with the calculated predicted shape.

20. (original): The apparatus according to claim 15, wherein

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the calculating unit successively calculates states of the wiring structure deformed from an arbitrary initial shape to a final shape which satisfies the predetermined condition, and the outputting unit successively outputs the calculated states of the wiring structure.

21. (currently amended): The apparatus according to claim 20 further comprising a second setting unit for setting a predetermined force applies to a predetermined portion of the wiring structure as the predetermined condition,

wherein the calculating unit successively calculates the deformation states of the wiring structure to which the force is applied, and the outputting unit successively updates and outputs the deformation state of the wiring structure based on the calculated deformation states of the wiring structure.

22. (currently amended): The apparatus according to claim 20 further comprising a temporary stopping unit for ~~temporary stop~~ temporarily stopping an output by the outputting unit by a trigger based on manual operation.

23. (currently amended): An apparatus ~~of~~ for assisting with a wiring design of a wiring structure in which the wiring structure ~~constituted by a plurality of pieces of line streak members~~ is ~~regarded~~ represented as an elastic body which has a circular section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled with each other, and a shape



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of the wiring structure which satisfies a predetermined condition is predicted by utilizing a finite element method, the apparatus comprising:

a first calculating unit for calculating an initial shape of the wiring structure based on a predetermined bending radius, a constrained position of the wiring structure and a constrained direction with respect to the wiring structure at the constrained position set as an initial value;

a setting unit for setting a condition concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure to the initial shape;

a second calculating unit for calculating a predicated shape of the forcibly displaced wiring structure such that the set condition is satisfied by utilizing the finite element method and the wiring structure is displaced; and

an outputting unit for outputting the predicted shape calculated by the second calculating unit for determining if the displaced wiring structure is located in a suitable position for the wiring design.

24. (currently amended): The apparatus according to claim 23 further comprising a verifying unit which provides information concerning a change in the shape characteristic, the material characteristic and the constraining condition to the predicted shaped output by the outputting unit, calculates again a new predicated shape of the forcibly displaced wiring structure by utilizing the finite element method and makes the outputting unit output the new calculated predicted shape to enable to verify verification of an optimum shape of the wiring structure.

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25. (currently amended): A recording medium storing a program which causes a computer to function as an apparatus ~~of~~ for assisting with a wiring design of a wiring structure in which the wiring structure ~~constituted by a plurality of pieces of line streak members is regarded~~ represented as an elastic body which has a circular section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled with each other, and a shape of the wiring structure which satisfies a predetermined condition is predicted by utilizing a finite element method, the program causing the computer to functions as:

a setting unit for setting information concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure as the predetermined condition;

a calculating unit for calculating a predicted shape of the ~~forcibly displaced~~ wiring structure by applying the predetermined condition to the finite element method such that the condition is satisfied and the wiring structure is displaced; and

an outputting unit for outputting the predicted shape calculated by the calculating unit for determining if the displaced wiring structure is located in a suitable position for the wiring design.

26. (currently amended): The recording medium according to claim 25, wherein the calculating unit calculates the predicted shape ~~where~~ such that the wiring structure is forcibly displaced so as to satisfy the condition.

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27. (original): The recording medium according to claim 25, wherein the program causes the computer to calculate strain and stress of the wiring structure, and output the calculated strain and stress together with the calculated predicted shape.

28. (original): The recording medium according to claim 25, wherein the program causes the computer to calculate reaction force and moment produced at a constraining point of the wiring structure, and output the calculated reaction force and moment together with the calculated predicted shape.

29. (original): The recording medium according to claim 25, wherein the program causes the computer to successively calculate deformation states of the wiring structure deformed from an arbitrary initial shape to a final shape which satisfies the predetermined condition, and successively update and output the deformation state of the wiring structure based on the calculated states of the wiring structure.

30. (currently amended): A recording medium storing a program which ~~cause~~causes a computer to function as an apparatus ~~of~~for assisting with a wiring design of a wiring structure in which the wiring structure ~~constituted by a plurality of pieces of line-streak members~~ is regarded represented as an elastic body which has a circular section and in which a plurality of linear beam elements ~~a linearity of which is maintained~~ are coupled with each other, and a shape of the

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wiring structure which satisfies a predetermined condition is predicted by utilizing a finite element method, the program causing the computer to function as:

a first calculating unit for calculating an initial shape of the wiring structure based on a predetermined bending radius, a constrained position of the wiring structure and a constrained direction with respect to the wiring structure at the constrained position set as an initial value;

a setting unit for setting a condition concerning a shape characteristic, a material characteristic and a constraining condition of the wiring structure to the initial shape;

a second calculating unit for calculating a predicated shape of the ~~forcibly displaced~~ wiring structure by utilizing the finite element method such that the set condition is satisfied and the wiring structure is forcibly displaced; and

an outputting unit for outputting the predicted shape calculated by the second calculating unit for determining if the displaced wiring structure is located in a suitable position for the wiring design.

31. (currently amended): A method of assisting with a wiring design of a wiring structure by calculating a predicted shape concerning a ~~the~~ wiring structure ~~constituted by a plurality of pieces of line-streak members~~, the method comprising the steps of:

successively calculating deformation states of the wiring structure deformed from an arbitrary initial shape to a ~~final~~ final shape; and

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successively outputting the calculated states for determining if the final shape  
represents the wiring structure located in a suitable position for the wiring design.